

# MEMORANDUM

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Subject: **Model Issues in the South Coast AQMD's Net Emissions Analysis Tool (NEAT)**

Ramboll has reviewed the South Coast AQMD's Net Emissions Analysis Tool (NEAT) Version 1.11 Beta. Related purely to model performance (and separate from issues related to model inputs and assumptions), we found the following inconsistencies and potential errors in model behavior and output.

December 4, 2020

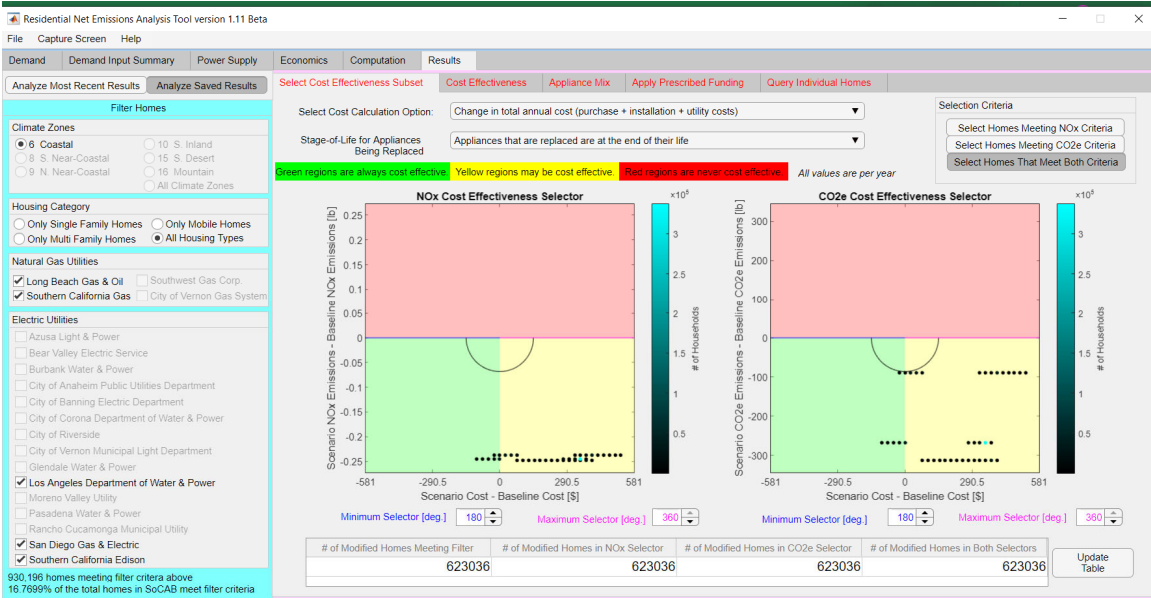
## 1) Selection of a Subset of Housing Stock

- We encountered unexpected and conflicting results when running the tool for a subset of the SCAB housing stock (e.g., selecting Climate Zone 6 in the input tab) as compared to running the model for the full housing stock and filtering the results for the same subset (i.e., filtering for Climate Zone 6 in the results tab). The test case we ran was to replace conventional NG water heaters with electric water heaters, using basin-average electricity. All other options were set to their default settings. Results for the former are shown in **Figure 1** below and results for the latter are shown in **Figure 2** below. Note that the following results are different depending on the whether a model subset was run compared to filtering full results for the same subset:
  - Number of modified homes meeting the subset filter (623,036 in the former vs. 665,899 in the latter);
  - Different cost differentials (e.g., the x-axis for the former scenario range between  $\pm$  \$581, whereas they range between  $\pm$  \$631 for the latter; and
  - Significantly different GHG emission results (all homes showing a decrease in GHG emissions in the former vs. all homes showing increased GHG emissions in the latter).

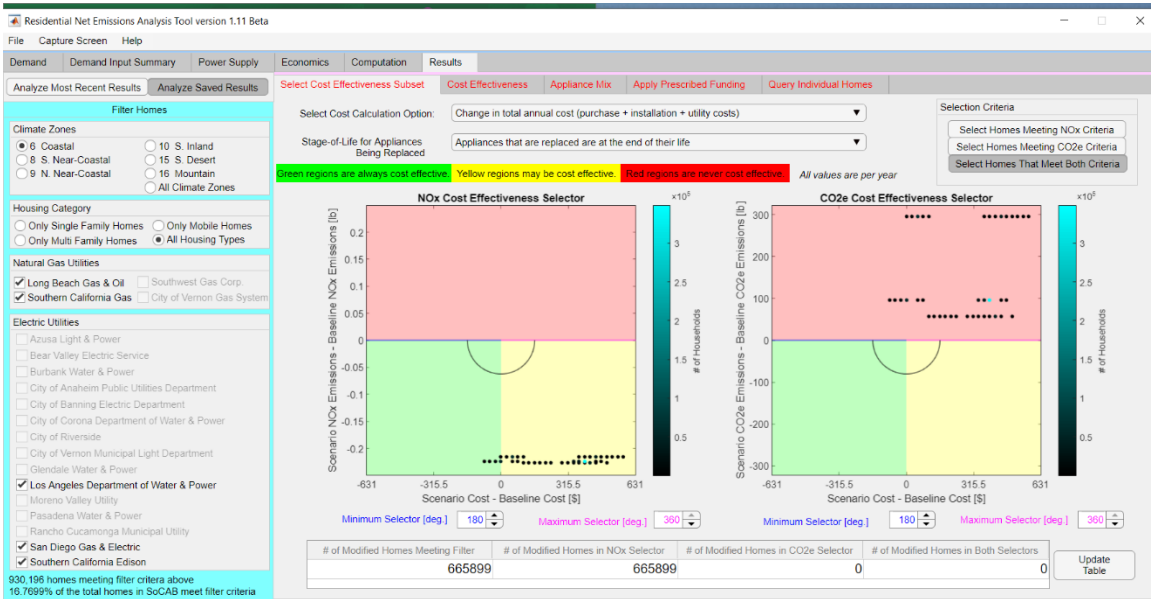
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**Figure 1: Running NEAT for housing stock in Climate Zone 6. The sample scenario was configured to replace conventional NG water heaters with electric water heaters.**



**Figure 2: Running NEAT for all climate zones and filtering the results for Climate Zone 6. The sample scenario was configured to be the same as in Figure 1 (replacing conventional NG water heaters with electric water heaters).**

## 2) Missing or Invalid GHG Cost-Effectiveness Results

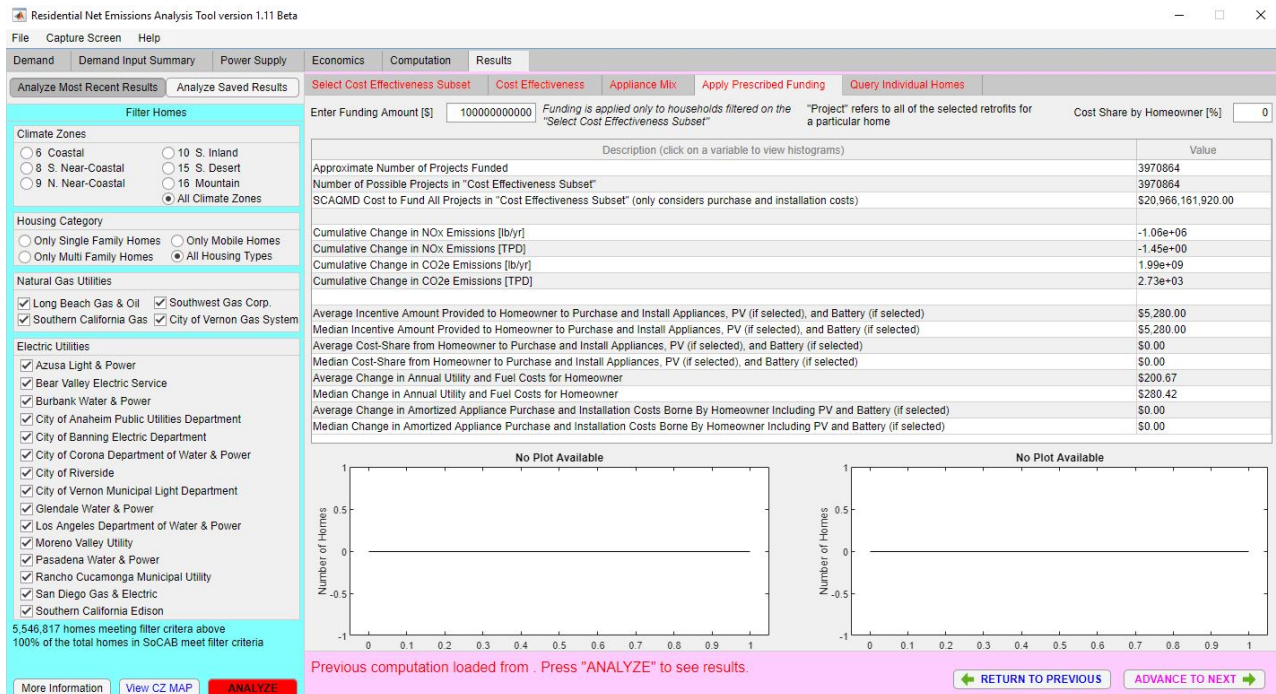
- Cost-effectiveness metrics in the “Results→Cost Effectiveness” tab of the NEAT model are either missing or invalid (i.e., “NaN”) for GHG, as seen in **Figure 3** below. The test case we ran was to replace conventional NG water heaters with electric water heaters, using basin-average electricity. All other options were set to their default settings. Most of the houses fall under the “Red CO2e” region; however, the tool only calculates a minimum and maximum GHG cost-effectiveness but does not provide values for the mean and median GHG cost-effectiveness.



**Figure 3: NEAT cost-effectiveness outputs for replacement of conventional NG water heaters with electric water heaters.**

### 3) Inconsistency between total GHG emissions and GHG Cost-Effectiveness Results

- Cost-effectiveness metrics for GHGs in the “Results→Cost Effectiveness” tab of the NEAT model were found to be inconsistent with the cumulative change in CO2e emissions reported in the “Apply Prescribed Funding” tab. The test case we ran was to replace conventional NG water heaters with solar water heaters with electric backup, using basin-average electricity. All other options were set to their default settings.
- As seen in **Figure 4** below, the test scenario we ran resulted in an increase in CO2e emissions of approximately 2,700 tons/day from all houses in the basin (this was calculated by setting a very high funding amount in the “Apply Prescribed Funding” tab, such that all houses basin-wide would be subject to appliance replacement and therefore be included in the cumulative change in emissions reported within that tab). The “Apply Prescribed Funding” tab also indicates that there is a positive cost to fund all projects (purchase and installation costs) and an average increase in annual utility and fuel costs for Homeowner.
- However, the cost-effectiveness results show all homes are in the “Yellow” region for CO2e (see **Figure 5**). This implies that either costs or emissions are lower in the scenario than the baseline for all houses, which is inconsistent with the information presented in the “Apply Prescribed Funding” tab.



**Figure 4:** Cumulative change in emissions reported in the “Apply Prescribed Funding” tab of the NEAT model. The results are for replacement of conventional NG water heaters with solar water heaters with electric backups.



**Figure 5: NEAT Cost-effectiveness outputs for replacement of conventional NG water heaters with solar water heaters with electric backups.**

#### 4) Memory Error

- An Out-of-Memory error was encountered when attempting to run NEAT with replacement of natural gas (NG) primary heat with electric heat pumps for the full South Coast Air Basin (SCAB) housing stock, with the Rooftop Solar PV option enabled.